MARYLAND WATER MONITORING COUNCIL

9TH ANNUAL CONFERENCE
13 NOVEMBER 2003
LINTHICUM, MARYLAND

PROGRAM & ABSTRACTS

ECOLOGICAL RESTORATION ASSESSMENT & MONITORING

Some Ponderings for Number 9*

The theme of this year's MWMC Annual Conference embraces an exciting but also very challenging topic: *Ecological Restoration Assessment & Monitoring.* Captured by this topic is the important understanding that aquatic and terrestrial ecosystems perform numerous valuable environmental functions. Aquatic ecosystems recycle nutrients, purify water, attenuate floods, augment and maintain stream flow, recharge ground water, and provide habitat for wildlife and recreation for people. In spite of our efforts to protect ecosystems, human activities have altered their physical, chemical, and biological processes. Where environmental protection has failed, more complex and costly management actions—collectively labeled *restoration*---are needed.

The premise of this year's conference theme is that ecological restoration of aquatic ecosystems is possible. Successful restoration programs must recreate or repair ecosystem structure and function such that natural dynamic processes operate effectively again. Often, ecological restoration requires one or more of the following actions: chemical cleanup or adjustment of the environment; reconstruction of antecedent physical hydrologic and morphologic conditions; and biological manipulation, including revegation and reintroduction of absent or currently nonviable native species (National Research Council 1992).

To get everyone in the mood to learn about ecological restoration, I encourage you to ponder these thoughts:

> "The acid test of our understanding is not whether we can take ecosystems to bits on pieces of paper, however scientifically, but whether we can put them together in practice and make them work."
>
> A.D. Bradshaw, 1983

> "Any nation concerned about the quality of life, now and forever, must be concerned about conservation. It will not be enough to merely halt the damage we've done. Our natural heritage must be recovered and restored. It's time to renew the environmental ethic in America----and to renew U.S. leadership on environmental issues around the world. Renewal is the way of nature, and it must now become the way of man."
>
> Vice President George Bush, 1988

> "It is axiomatic that no restoration can ever be perfect; it is impossible to replicate the biogeochemical and climatological sequence of events over geological time that led to the creation and placement of even one particle of soil, much less to exactly reproduce an entire ecosystem. Therefore, all restorations are exercises in approximation and in the reconstruction of naturalistic rather than natural assemblages of plants and animals within their physical environments."
>
> J.J. Berger, 1990

Ecological restoration is a key management activity for local, state, and federal agencies and also community groups working and living in Maryland, and also throughout the Chesapeake Bay watershed. Specifically, the Stream Corridor Restoration Goal is one of 93 commitments in the Chesapeake 2000 (C2K) agreement. Streams are an integral part of the Bay's natural infrastructure. Stream networks interconnect the land, water, living resources, and human communities of the Bay watershed. Improving, restoring, and protecting stream ecosystems assumes a pivotal point in moving the Bay and its watershed resources towards the ideal condition. The C2K commitment that specifically addresses this topic is captured in this charge*: "By 2004, each jurisdiction, working with local governments, community groups and watershed organizations, will develop stream corridor restoration goals based on local watershed management planning."*

REFERENCES

Berger, J.J. 1990. Evaluating ecological protection and restoration projects: A holistic approach to the assessment of complex, multi-attribute resource management problems. Doctoral dissertation. University of California, Davis.

Bradshaw, A.D. 1983. The reconstruction of ecosystems. Journal of Applied Ecology 20:1-17.

National Research Council. 1992. Restoration of aquatic ecosystems: Science, technology, and public policy. National Academy Press, Washington, D.C.

* Compiled by Ron Klauda

WELCOME !!

9TH Annual Conference
Maryland Water Monitoring Council

Thursday, November 13, 2003
Maritime Institute
5700 Hammonds Ferry Road
Linthicum Heights, MD 21090
http://www.mitags.org

The Maryland Water Monitoring Council's 9th Annual Conference provides a forum for individuals involved with or interested in water monitoring activities to meet and talk to others with similar interests from local, state, and federal agencies; universities; consulting groups; the industrial sector; and citizen monitoring organizations.

The theme of this year's conference is

ECOLOGICAL RESTORATION ASSESSMENT & MONITORING.

To learn more about the Maryland Water Monitoring Council, please go to:
http://www.mgs.md.gov/mwmc

The work of the MWMC is conducted by a several dedicated committees and
a multi-institutional, multi-jurisdictional Board of Directors. The current membership list appears at the end of this booklet.

2003 CONFERENCE PLANNING COMMITTEE

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Thursday, November 13, 2003
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Linthicum Heights, MD

Morning Plenary Session (9:00-12:15)
Auditorium

8:30 *Registration*

9:00 *Welcome, Announcements and Introduction of Keynote Speakers*
Bill Stack (Chairman of the Board of Directors of the Maryland Water Monitoring Council)

9:15 *Keynote Addresses*
C. Ronald Franks (Secretary, Maryland Department of Natural Resources)
Stephen L. Pattison (Assistant Secretary for Programs, Maryland Department of the Environment)

9:30 *MWMC News*
Bill Stack and Committee Chairs (Ron Klauda, Steve Stewart, Matt Rowe, Cheryl Klohe, Bob Shedlock)

9:45 *Growing Role of Monitoring and Monitoring Councils in America's Water Programs*
Chuck Spooner (US Environmental Protection Agency, Office of Water)

10:15 *New Methods for Urban Stream Restoration Assessment and Monitoring*
Ted Brown (Center for Watershed Protection)

Break and Poster Session (10:45)

11:15 *Monitoring Restoration of the Agricultural Component of Coastal Plain Watersheds*
Ken Staver (University of Maryland, Wye Research and Education Center)

11:45 *Submerged Aquatic Vegetation Restoration in Chesapeake Bay*
Mike Naylor (Maryland Department of Natural Resources)

Lunch and Poster Session (12:15)

Update on a Framework for Stream Bioassessment in the Nontidal Potomac
L. Astin (Interstate Commission on the Potomac River Basin)

The National Aquarium in Baltimore's Use of Publicly Accessible Water Quality Data as an Education Tool
Laura Bankey and Angie Ashley (Conservation Department, National Aquarium in Baltimore)

Charles County Watershed Prioritization
Ian Botts, Michael Pieper, Nathan Drescher, William Frost (KCI Technologies, Inc.)

Comparability of Benthic Macroinvertebrate Multi-habitat Sampling Methods
David Bressler and James B. Stribling (Tetra Tech, Inc.)

Accessing Vegetative Factors Before and After Stream Restoration,
Lakesha Coates, MD DNR

Watts Branch Watershed and Stream Assessment, Washington D.C.
Chris Eng, Richard Starr, Tamara McCandless (Stream Habitat Assessment and Restoration Program, Chesapeake Bay Field Office, U. S. Fish and Wildlife Service)

River Restoration in our Nation: A Scientific Synthesis to Improve Results
B.A. Hassett, E.S. Bernhardt, M.A. Palmer, J.D. Allan, M. Bowman, and the National River Restoration Science Synthesis working group

Coupling Science with Outreach: Maryland's Stream Waders Program
Ronald J. Klauda, Daniel M. Boward, and Rita M. Bruckler (Maryland Department of Natural Resources)

James Island Habitat Restoration and Assessment of Existing Environmental Conditions
S.T. Koser, J. Matkowski, J. Boraczek (EA Engineering, Science, and Technology, Inc.), K.Cushman (Maryland Environmental Service)

Interpretation of the Fluvial Geomorphic Response of Streams to Developing Watersheds
Hunt Loftin (Tetra Tech, Inc.)

From Drought in 2002 to Recovery and Flooding in 2003
Wendy S. McPherson (U.S. Geological Survey)

Aquatic Benthic Macroinvertebrates as Indicators of the Health of a Coastal Plain Stream
Karyn Molines (Jug Bay Wetlands Sanctuary)
Will *Crassostrea virginica* Thrive in the Magothy River? A Study of Oyster Gardens in a Mesohaline Chesapeake Bay Tributary,
Kate O'Mara and Sally G. Hornor (Anne Arundel Community College)

Watershed-Based Biological Monitoring in Howard County, Maryland
Kristen L. Pavlik and James B. Stribling (Tetra Tech, Inc.)

Assessing Restoration Opportunities in Lower Bush Creek Watershed, Frederick County, Maryland
Morris Perot, Nancy Roth, Sanjay Chandra (Versar Inc.), Shannon Moore (Frederick County Division of Public Works)

Streamstats: A U.S. Geological Survey Web Site for Stream Information
Kernell G. Ries III (U.S. Geological Survey)

Ecological Restoration of Urban Streams: Using Living Resources to Measure Success
Keith Van Ness (Montgomery County Department of Environmental Protection), Doug Redmond (Maryland-National Capital Park and Planning Commission)

Afternoon Plenary Session (1:15 -2:00)
Auditorium

1:15 *Placing Water Quality Monitoring within the Framework of Ecological Restoration*
Keith Bowers (Biohabitats, Inc. and incoming Chairman for The Society for Ecological Restoration International)

Concurrent Sessions (2:00-3:00 and 3:20-4:30)

Session 1 (2:00)--Auditorium
Stream Assessments and Restoration in Urban Areas,
Organized by Ken Yetman, Maryland Department of Natural Resources, Annapolis. (410) 260-8812, kyetman@dnr.state.md.us

Session Synopsis: Ecological restoration of streams is a fairly new and evolving science. Not too long ago, lining stream channels with concrete, gabion baskets or rip rap was a well accepted practice, especially in urban areas. Today, greater emphasis is given to restoring in-stream habitat and natural stream processes. However, this can be especially challenging in urban areas where large amount of impervious surfaces and poor storm water management result in highly erosive flows even during small storm events. Despite this and other challenges, the majority of people in Maryland live in urban areas and they want clean healthy streams in the neighborhoods where they live. The session will examine some of the restoration efforts that are presently underway in Maryland's urban areas, how restoration efforts are prioritized, and the monitoring that is being done to determine if they are successful in reaching their restoration goals.

Restoration Monitoring at Multiple Scales - Baltimore County Perspective,
Steve Stewart (Baltimore County Department of Environmental Programs)

Prioritization of Howard County Watersheds for Preservation or Restoration
Hunt Loftin (Tetra Tech, Inc.)

Stony Run Geomorphological Monitoring Study
Drew Altland (STV, Inc.) and Bill Stack (City of Baltimore, DPW)

Techniques for Monitoring and Assessing Social and Ecological Dynamics in Watershed 263
Guy Hager (Parks & People Foundation), Ken Belt (Hydrology Research, U.S. Forest Service and Baltimore Ecosystem Study) and Morgan Grove (Social Research, U.S. Forest Service)

Grassroots Restoration of the Anacostia River
Jim Connolly (Anacostia Watershed Society)

Session 2 (2:00)---Room A300
Stream Assessments and Restoration in Agricultural Areas
Organized by John McCoy, Maryland Department of Natural Resources, Annapolis.
(410) 260-8803, jmccoy@dnr.state.md.us

Session Synopsis: Agricultural lands are credited with contributing approximately 38% of the nitrogen and 41% of the phosphorus to the Chesapeake Bay. To understand and manage nutrient inputs and exports from agricultural lands, one must understand the use of nutrients in cropping systems and the movement of nutrients out of such systems. This session will examine the nature of nutrient use with various agricultural cropping systems, the pathways for nutrient loss, and the effectiveness of our efforts to reduce nutrient losses from these systems.

Nutrient Transport to Surface and Groundwater on the Delmarva Peninsula
Judy Denver (USGS)

Principles for Managing Agricultural Nitrogen
Dr. Jack Meisinger USDA/ARS

Nutrient Fate and Transport Associated with Poultry Litter Stock Piles
Dr Gary Felton (University of Maryland, CES)

The Effect of Nutrient Management and Cover Crops on In-stream Nutrient Concentrations in Green Branch
John McCoy (Maryland Department of Natural Resources)

Session 3 (2:00)---Bridge Room

Assessing and Restoring Maryland's Tidal Environment

Organized by Kim Coble, Chesapeake Bay Foundation. (410) 268-8833, kcoble@cbf.org

Session Synopsis: Maryland watersheds and the tidal portion of the Chesapeake Bay are integrally linked. Many components of Maryland's economy and the quality of life for Maryland's citizens are dependent upon a healthy Chesapeake Bay. This session will focus upon restoring and monitoring the tidal portion of the Bay. During the session, there will be an overview of tidal restoration projects, as well as specific information on restoring and monitoring oysters, wetlands, shorelines, and underwater grasses.

Overview of Assessing and Restoring Maryland's Tidal Environments and Oyster Population
Rich Takacs (Mid-Atlantic Restoration Coordinator, NOAA Restoration Center)

Tidal Wetland Restoration Through Small Scale Use of Dredged Material
David Nemerson (National Aquarium in Baltimore)

Assessing and Restoring Underwater Grasses
Peter Bergstrom (NOAA Chesapeake Bay Office)

Living Shoreline Treatments and the Need for Monitoring and Assessment
David Burke (Burke Associates)

Break and Poster Session (3:00)

Sessions 1, 2 and 3 Resume (3:20)

Conference Adjourned (4:30)

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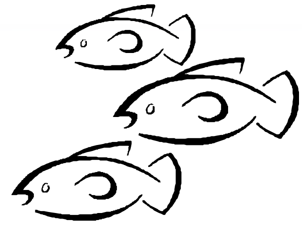

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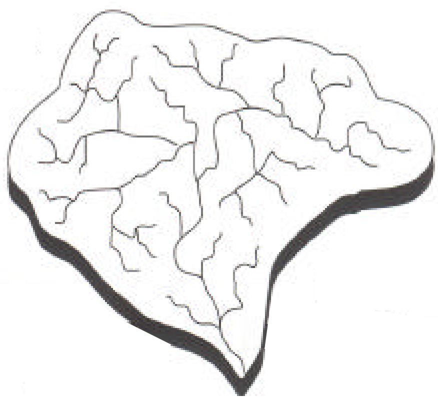

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Nancy Roth
Watershed Program Manager
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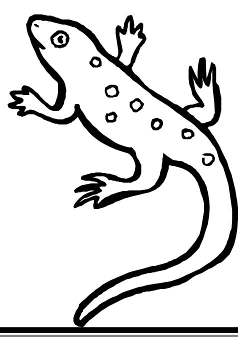

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Conference Presentation Abstracts

Stony Run Geomorphological Monitoring Study

Drew Altland (STV, Inc.) and Bill Stack (City of Baltimore, DPW)

ABSTRACT: In support of a Municipal Stormwater Permit for the City of Baltimore's Department of Public Works – Water Quality Management Section, STV has performed a geomorphological monitoring study for Stony Run, a tributary to the Jones Falls, as part of a comprehensive watershed management plan. The Stony Run (3.3 square mile) watershed is located in the highly urbanized central region of Baltimore City, which has a computed impervious area of approximately 38%. The presentation will report the morphological changes in the stream channel over multiple time periods using monumented cross sections and bank pin data to compute the rate of erosion in tons per year. To determine the accuracy of the stability predictions using the Bank Erodibility Hazard Index and the Near Bank Shear Stress methodologies, comparisons of the predicted and measured erosion rates will be presented. In addition, sediment samples have been collected from the eroding stream banks at the monumented cross sections, so that the nutrient loads delivered to the Jones Falls can be estimated.

Assessing and Restoring Underwater Grasses

Peter Bergstrom (NOAA Chesapeake Bay Office)

ABSTRACT: Monitoring and assessment play several key roles in the restoration of underwater bay grasses. First, recent and historical monitoring of the locations and sizes of underwater grass beds are needed to identify areas in need of restoration. Recent and historical distribution by species is very useful if it is available, since it aids in species selection. Second, recent water quality monitoring data from near the potential planting sites are needed to identify sites that currently lack underwater grasses, but may be able to support restored beds. Ideally this monitoring should continue throughout the restoration process, to help understand planting success or failure. Third, small test plantings should be done and their survival assessed for at least a year to identify specific planting locations. Finally, the survival of any planted beds needs to be assessed often enough and long enough (at least two years) to identify likely causes of failure if this occurs.

Placing Water Quality Monitoring within the Framework of Ecological Restoration

Keith Bowers (Biohabitats, Inc. and incoming Chairman for The Society for Ecological Restoration International)

ABSTRACT: Water quality monitoring is increasingly becoming a component of much larger and more complex land management initiatives. Typically these initiatives involve the restoration of wetlands, rivers and riparian corridors. Restoring ecosystems can be a complex and multifaceted undertaking, taking in a host of factors and a large matrix of possibilities. How then does water quality monitoring fit within the overall context of ecological restoration?

Over the past twelve years The Society for Ecological Restoration International (SER International) has developed two documents that serve as a starting point for defining restoration and providing a framework on which to base water quality monitoring. The SER Primer on Ecological Restoration and the Guidelines for Developing and Managing Ecological Restoration Projects provide a solid, scientific and widely accepted foundation for ecological restoration. These two documents and their relevance to water quality monitoring will be discussed.

New Methods for Urban Stream Restoration Assessment and Monitoring

Ted Brown (Center for Watershed Protection)

ABSTRACT: This paper focuses on new guidance developed by the Center for Watershed Protection detailing a systematic assessment of potential restoration opportunities within the stream corridor and subwatershed known as the Unified Stream Assessment (USA) and the Unified Subwatershed and Site Reconnaissance (USSR). The USA is a rapid assessment of all surface drainage in a subwatershed to identify problems and opportunities within the stream corridor. The USA evaluates eight stream impacts or conditions, including storm water outfalls, severe erosion, impacted buffers, sewer lines, stream crossings, channel modifications, dumping and miscellaneous impacts. The USSR explores pollution sources and restoration opportunities that exist in upland areas of the subwatershed. The USSR is essentially a windshield survey that profiles current practices in residential, commercial, industrial and municipal areas; the condition of streets and storm drains; the potential for on-site retrofits; and confirms the location of storm water hotspots and industrial storm water discharges. Together, these assessment methods provide watershed managers with a comprehensive picture of subwatershed conditions and the restoration options available. This information becomes the building blocks of the small urban watershed restoration strategy.

Living Shoreline Treatments and the Need for Monitoring and Assessment

David Burke (Burke Associates)

ABSTRACT: The Keith Campbell Foundation for the Environment and several cooperating entities are involved in a Living Shorelines Stewardship Initiative designed to increase living resources on private properties surrounding the Bay. "Living shoreline" treatments can be used to reduce sediment and nutrients by stabilizing shorelines in low and medium wave energy areas and to establish vital habitats that help sustain or enhance a variety of plant communities and living resources found at the water's edge. These naturalized shoreline treatments emphasize the use of techniques such as: marsh plantings; supplementary beach nourishment; sill and breakwater control with added SAV and oyster enhancement; and other combinations of strategically placed structural and organic materials.

Experimentation and innovations in living shoreline treatments are proceeding at a rapid rate, yet documentation of the successes and failures of these applications is scant. Older non-structural projects and recent innovative treatments need to be monitored and assessed to document changes in the structural integrity of alternative designs, biological conditions, water quality and shoreline dynamics. Baseline and customized monitoring protocols will be developed within the scope of the Living Shorelines Stewardship Initiative to help identify effective living shoreline treatments and appropriate site suitability criteria.

Grassroots Restoration of the Anacostia River

Jim Connolly (Anacostia Watershed Society)

ABSTRACT: The Anacostia River watershed encompasses portions of Montgomery and Prince George's Counties and the District of Columbia. This 176 square mile watershed is urban in nature, with portions being over 50% impervious. It is plagued by typical urban pollutants, such as sediment, toxics, nutrients, trash and sewage, mostly associated with storm water impacts from its impervious areas. The Anacostia Watershed Society (AWS) is a local, non-profit environmental organization that is working to restore the river to a swimmable and fishable condition. Working with thousands of volunteers and school groups, AWS has planted over 11,000 trees throughout the watershed, removed over 478 tons of trash and 7,500 tires from the river, established native Wild Rice and other emergent plants in the river's wetlands, and restored two sections of severely eroded streambank on the Northwest Branch tributary, all with minimal resources and maximum effectiveness. This talk will highlight the grassroots approach AWS has employed to bring hope back to the Anacostia River, with particular emphasis on low-tech approaches.

Nutrient Transport to Surface and Groundwater on the Delmarva Peninsula

Judy Denver (USGS)

ABSTRACT: Nutrients move readily from application areas through both ground water and surface runoff to streams on the Delmarva Peninsula. Ground water discharged from the surficial aquifer is the primary source of nitrate in streams, whereas phosphorus is primarily contributed to streams through overland runoff during storms. The median concentration of nitrate in ground water in the surficial aquifer is about 5 mg/L as nitrogen; nitrate concentrations are greater than 3 mg/L as nitrogen in about half of the headwater streams on the Peninsula during base-flow conditions in the spring. Concentrations of phosphorus are typically below 0.1 mg/L in ground water and in most streams during spring base-flow conditions, and can increase to greater than 1 mg/L in runoff during storms.

The processes that control the movement of nutrients to ground water and streams are related to local variability in hydrologic and geochemical conditions determined by landscape, soil, and geology. In well-drained watersheds overlying thick sandy aquifers with incised streams (such as those in Kent County, Maryland) nitrate is preferentially transported as a dissolved ion through ground water to streams. Less soluble nutrients move primarily through physical transport processes in runoff. In contrast, in flat poorly drained watersheds underlain by a thin surficial aquifer, such as the upper Pocomoke River Basin in Wicomico and Worcester Counties, Maryland, surface runoff is limited to particularly significant precipitation events. Ground-water discharge from the surficial aquifer and an underlying partially confined aquifer is the most important factor controlling stream chemistry in this area.

Nutrient Fate and Transport Associated with Poultry Litter Stock Piles

Gary Felton (University of Maryland, CES)

ABSTRACT: The effects of poultry litter stockpiles on nutrient availability and movement were evaluated for the major poultry producing regions in Maryland. The effect of covering stockpiles with tarps was compared to uncovered piles. An upland Coastal Plain soil and a lowland Coastal Plain soil were used. Surface runoff was captured and nutrient analysis was done. Subsurface flow was sampled for nutrient content. In runoff water, covering piles resulted in a 9% reduction in nitrate on a sandy soil, but had no advantage on a silty clay loam. Orthophosphate concentrations were reduced by a factor of 47 on the sandy loam soil but were again unaffected on the silt clay loam soil. Uniformly, covering plots reduced the nitrate concentration in soil water beneath the plots, regardless of soil type. However, when piles were removed, all concentrations converged (with time) to the uncovered levels.

Techniques for Monitoring and Assessing Social and Ecological Dynamics in Watershed 263

Guy Hager (Parks & People Foundation), Ken Belt (Hydrology Research, U.S. Forest Service and Baltimore Ecosystem Study) and Morgan Grove (Social Research, U.S. Forest Service)

ABSTRACT: Watershed 263 is a new, innovative public-private partnership project to prepare and implement a model urban storm sewer Watershed Management Plan as an official Baltimore City guide for restoration. Through collaboration among several organizations with various expertises, the project will collect evaluation and research data and develop methods and tools for decision making and management in order to improve the quality of urban land and water resources contributing to urban revitalization. The social and ecological data to be collected and monitored over time will include vegetation health, water quality, quality of life indicators and more.

Prioritization of Howard County Watersheds for Preservation or Restoration

Hunt Loftin (TetraTech, Inc.)

ABSTRACT: Howard County developed a screening and ranking process that provides a publicly and politically defensible framework for developing and implementing a program for the preservation or restoration of all County subwatersheds. The program addresses the Maryland Department of the Environment's National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System (MS4) permit requirements to select a watershed area for restoration that contains at least ten percent of the County's impervious area. Howard County's screening and ranking process makes use of existing geographic information system (GIS) coverage for existing and future land use, topography, and stream network as well as information gathering from NPDES and other environmental studies. The process supports the County's actions to meet NPDES MS4 permit requirements as well as develop long-term countywide watershed management plans. The process is transferable and easily modified to meet the requirements of other jurisdictions

The Effect of Nutrient Management and Cover Crops on Water Quality in Green Run

J.L. McCoy, M. Sigrist, and J. Jaber (Maryland Department of Natural Resources)

ABSTRACT: The Pocomoke River, located on the Eastern Shore of Maryland, is one of four major tributaries of the Chesapeake Bay. In 1994, the Wicomico Soil Conservation District (SCD) invited Maryland Department of Natural Resources (MD DNR) and United States Geological Survey (USGS) to join in a project demonstrating the effect of nutrient and poultry litter management on water quality. The project is designed as a paired watershed experiment. The north fork of Green Run was selected as the control watershed and the south fork of Green Run as the treatment watershed. The 2,342-acre control watershed contains 58% cropland and 42% woodland land usage, and an annual chicken production (broiler) capacity of 3,493,000. The 1,779-acre treatment watershed is 54%

cropland and 46% woodland with an annual broiler production capacity of 1,400,000.

Net surpluses of nitrogen (N) and phosphorous (P) applied to cropland during the calibration period (1994-1998) averaged 152 lbs/acre and 42 lbs/acre, respectively, in the control watershed. The treatment watershed averaged 143 lbs/acre and 52 lbs/acre, respectively, during the calibration period. N and P yields from the watersheds during the calibration period averaged 11.59 lbs/acre/yr and 0.81 lbs/acre/yr, respectively, from the control watershed, and 20.15 lbs/acre/yr and 3.17 lbs/acre/yr, respectively, from the treatment watershed.

The treatment program that began in 1998 consists of complete poultry litter removal and replacement with recommended rates of inorganic fertilizer, as well as growing cover crops on all available cropland in the treatment watershed. Nutrient budgets indicate that nutrient surpluses in the control watershed have remained constant, while nutrient surpluses in the treatment watershed have decreased 92% for N and 98% for P. Water quality results indicate that the treatment program has resulted in a 27% decrease in total nitrogen concentrations being discharged from the treatment watershed

Principles for Managing Agricultural Nitrogen

John J. Meisinger (USDA-ARS)

ABSTRACT: Managing agricultural nitrogen (N) to minimize N losses is a challenge to nutrient managers who must develop nutrient management plans that consider rate and application strategies that account for hydrology, soil properties, and crop-tillage systems of a specific site. Ammonia losses are becoming a renewed concern, which can be managed by soil incorporation. Nitrogen leaching is a significant loss, with leaching events occurring when soil nitrate concentrations are high and water is moving through the soil profile. The universal tools for managing N leaching include understanding the soil-crop-hydrologic cycle because hydrology drives N losses, avoiding excess N applications because excess N is most vulnerable to loss, and applying N in-phase with crop demand because this increases crop N recoveries. Cropping system tools for managing leaching include use of grass cover crops, and adding a legume or deep-rooted crop to a rotation. Other approaches include use of riparian zones and conservation reserve program areas. Site monitoring tools such as the pre-sidedress soil nitrate test, and the leaf chlorophyll meter are useful in identifying N sufficient sites and avoiding excess N rates. Real-time monitoring techniques, combined with variable rate N applicators, offer new opportunities for improving N management . The application of the above N management tools to fields, or specific management areas within a field, will improve crop N recoveries with subsequent reductions in N losses to the environment.

Submerged Aquatic Vegetation Restoration in Chesapeake Bay

Mike Naylor (Maryland Department of Natural Resources)

ABSTRACT: Research, monitoring and implementation projects over the past 30 years have demonstrated that submerged aquatic vegetation (SAV) is one of the most important biological communities in the Chesapeake Bay. The bay states have committed significant resources during this period to determine the causes for the greatly reduced SAV populations in the Bay and its tributaries, to set new restoration baselines, and to identify the most appropriate methods for protecting and restoring SAV populations. A formal Restoration Strategy has been developed to build a consensus among the partners of the Chesapeake Bay Program to determine how best to accelerate the restoration of the bay's SAV. Building on the results of past transplanting, and using the guidance of the Restoration Strategy, several of the largest SAV restoration projects ever undertaken on the East Coast are now underway. A great diversity of assessment and monitoring tools and methods are being used to insure that no matter the results of each individual activity, large strides will be made in understanding the success or failure of restoration activities.

Tidal Wetland Restoration Through Small Scale Use of Dredged Material

David Nemerson (National Aquarium in Baltimore)

ABSTRACT: The National Aquarium in Baltimore (Aquarium) and its partners have been developing a cooperative program to restore tidal wetlands in the Chesapeake Bay and develop a community-based infrastructure for long-term, science-based monitoring. Partners include NOAA, USFWS, USACE, state and local governments and community groups. Using dredged material, marshes are created on the exposed shores of eroding islands. The Aquarium mobilizes and trains volunteers to plant and monitor the sites. Given their location on high-energy shores, the sites' physical stability and performance of protective structures are key attributes. One four-hectare site created behind geotubes has displayed excellent stability; loss in elevation is due to dewatering and compaction, not erosion. Plants are doing well and are beginning to coalesce. Resident animal species are abundant and reproducing. Long-term stability remains unknown due to possible geotube failure and resulting erosion. At a one-hectare site placed behind riprap, marsh establishment is also proceeding. Vegetation is doing well and coalescing. The site remains dynamic; sediment is accreting behind the riprap and eroding behind the openings. Other sites are displaying similar results. While early in development, results show this model has the potential to produce high quality marsh habitat, create important citizen commitment to stewardship, and provide a useful infrastructure for long-term monitoring.

Monitoring Restoration of the Agricultural Component of Coastal Plain Watersheds

Ken Staver (University of Maryland, Wye Research and Education Center)

ABSTRACT: Committing major land resources to food production is essential to the sustainability of modern civilization. In the mid-Atlantic Coastal Plain, soil and climatic factors are favorable for production of the primary grains that are the backbone of our current food production system. As a result, grain production is the dominant land use in many Coastal Plain watersheds. In the last several decades it has become apparent that estuaries associated with many of these watersheds are severely impacted by excessive nutrient loads from agricultural areas. Most strategies for restoring coastal estuaries seek major reductions in nutrient loads from agricultural activities. While quantifying the effects of modifications in agricultural practices on nutrient losses is straightforward in small-scale experiments, measuring effects of implementation at larger-scales in mixed land use watersheds is much more difficult. The tendency to put all available resources toward implementation usually leaves minimal resources for monitoring the effects of implementation efforts on nutrient loads. Little monitoring would be needed if there were a high degree of certainty regarding the effectiveness of the practices being implemented. Unfortunately, the history of nutrient control efforts is relatively brief and the scientific underpinning is very limited, even at the experimental scale, regarding the effectiveness of many of the practices that are being implemented. Effectively monitoring progress toward meeting nutrient reduction goals with minimal resources will require consideration of the spatial and temporal dynamics of nutrient transport.

Reductions of both nitrogen (N) and phosphorus (P) loads from cropland are being sought in most estuarine restoration efforts. Although to some extent, N and P both move in all discharge from cropland, their behavior in soils, and primary pathways of transport are very different. Monitoring strategies need to be tailored to account for these differences. Phosphorus is transported primarily in overland flow generated for brief periods in close association with intense precipitation. A limited number of large events can dominate P loads in small watersheds on an annual basis or even across much longer time frames. A further complicating factor is that stream flow always includes base flow even during storm events, thus dampening changes in P concentrations in storm flow. Characterizing P losses requires rigorous storm event-based monitoring for long periods, and extreme natural variability will tend to make detection of modest reductions in P transport difficult. In the Coastal Plain, N loads from cropland tend to be dominated by nitrate transport through subsurface flow paths that discharge into streams or directly into tidal waters. Stream base flow nitrate concentrations provide an integrated estimate of watershed subsurface nitrate concentrations along with the effects of riparian and in-stream processes that retain nitrate. Much less rigorous monitoring strategies are needed to characterize watershed N loads on an annual basis. However, stream base flow is comprised of subsurface discharge ranging in age from months to decades, depending on watershed hydrogeology. Consideration of the temporal relationship between root zone nitrate leaching and stream base flow is essential if changes in stream N loads are to be correctly related to implementation activities.

Restoration Monitoring at Multiple Scales - Baltimore County Perspective

Steve Stewart (Baltimore County Department of Environmental Programs)

ABSTRACT: Baltimore County has developed a monitoring approach to watershed restoration at multiple scales. This approach provides project specific measures of restoration success and watershed restoration progress. The approach includes chemical, physical and biological measures of aquatic system improvement. In addition, research projects have been focused on areas where there is insufficient information on restoration effects. All stream restoration projects are monitored for post restoration stream stability through permanent cross sections and a subset are selected for biological and chemical monitoring. Monitoring on an eight-digit watershed scale includes random point selection macroinvertebrate biological monitoring, targeted base flow monitoring and storm event monitoring at USGS gages. Data from these programs will allow a trend analysis at the eight-digit watershed scale over time.

Completed research projects include storm event pollutant load reduction due to stream restoration and the effectiveness of urban riparian buffers in providing a variety of ecosystem services. Current research projects include pollutant removal efficiency of a storm drain cleaning program, the effectiveness of the new Stormwater Design Manual criteria in the protection of stream channels and the biotic community and changes in stream chemistry, and the pollutant removal efficiency of bioretention facilities.

Future monitoring efforts will be directed at the intermediate subwatershed scale as restoration Action Plans are completed over the next six years.

Growing Role of Monitoring and Monitoring Councils in America's Water Programs

Chuck Spooner (US Environmental Protection Agency, Office of Water)

ABSTRACT: EPA recognizes that water monitoring is a key ingredient of information-based environmental protection and the Office of Water has identified improved monitoring as among its highest priorities. State and regional water monitoring councils have become an important vehicle for promoting collaborative efforts, exploring new and emerging technologies, addressing changing expectations of monitoring, ensuring data and information comparability, and sharing results and successes. This presentation will discuss the role and growth of state and regional monitoring councils in America's water programs.

Overview of Assessing and Restoring Maryland's Tidal Environments and Oyster Populations

Rich Takacs (Mid-Atlantic Restoration Coordinator, NOAA Restoration Center)

ABSTRACT: Federal and state agencies, and environmental organizations have long been involved in monitoring and assessing resources to gage their "status". Recently, this has evolved into a more proactive role in the resource status, by coupling active restoration with monitoring and assessment. Specific engagement of citizens and watershed groups through "community-based Restoration Programs" has fostered additional awareness, support, and funding for restoration

activities. Along with and in partnership with a number of other similar programs, NOAA's Community-Based Restoration Program has grown from a $100K effort in 1997, to a $12M effort with dedicated restoration staff located throughout the country.

In the Chesapeake Bay, over 80 projects have been completed, and technical expertise and funding supports projects including tidal wetlands and island restoration, submerged aquatic vegetation restoration, fish blockage removal and shellfish restoration. The oyster has long played an important role in the economy and ecology of the Chesapeake Bay, and attempts to restore or enhance their abundance have occurred for nearly as long as the fishery for them has existed. Recognition of the water quality benefits that these filter feeders can produce, to the habitat architecture role that these reef builders fill, to the ecosystem role that these reefs provide, has resulted in widespread support for restoring oyster beds and reefs. Much of the large scale restoration underway drew its initial methods, science, and support from citizen-based restoration activities, which continue in parallel with the larger efforts even today.

MARYLAND WATER MONITORING COUNCIL

Ninth Annual Conference

Ecological Restoration Assessment & Monitoring

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Poster Session Abstracts

Update on a Framework for Stream Bioassessment in the Non-tidal Potomac

L. Astin (lastin@icprb.org), Interstate Commission on the Potomac River Basin, 6100 Executive Blvd. Suite 300, Rockville, MD, 20852

ABSTRACT: The Interstate Commission on the Potomac River Basin (ICPRB) is working to integrate biological monitoring data collected by the Basin jurisdictions (MD, PA, VA, WV) to produce composite indexes of ecosystem health in non-tidal Potomac waters. Issues and challenges encountered during the ongoing assessment framework development process will be presented, as well as future prospects for the resulting composite index. The index will ultimately provide integrated, quantitative information on the chemical, physical, and biological integrity of aquatic habitat in the non-tidal Potomac that is consistent across state boundaries, facilitating whole-watershed and interstate perspectives.

The National Aquarium in Baltimore's Use of Publicly Accessible Water Quality Data as an Education Tool

Laura Bankey (lbankey@aqua.org) and Angie Ashley (aashley@aqua.org), Conservation Department, National Aquarium in Baltimore, Pier 3 / 501 E. Pratt Street, Baltimore, MD 21202, (410) 659-4207 or (410) 576-1508

ABSTRACT: The National Aquarium in Baltimore (Aquarium) is using the educational power of the internet and GIS (geographic information systems) to inspire interest in local watersheds and teach the public how everyday actions can impact the environment several miles away. Visitors to the Aquarium's website are able to locate the watershed in which they live, discover why a healthy watershed is important, learn what factors affect water quality, and download real-time water quality data collected from a field station at the mouth of the Patapsco River near Baltimore Harbor, Maryland. Every 15 minutes, a Yellow Springs Instruments model 6600 sonde, suspended in the water column, records water temperature, dissolved oxygen, salinity, pH, turbidity, and chlorophyll concentration. At the same time interval, a nearby Campbell Scientific weather station measures air temperature, relative humidity, wind speed and direction, rainfall, photosynthetically active radiation, and atmospheric pressure. These data are uploaded to the Aquarium's website, where viewers are able to see how both weather events and man-made causes can alter water quality, thereby affecting the

plants and animals that live in and near the Chesapeake Bay. GIS technology is being used to creatively present and interpret these data as well as integrate other environmental information. For those without Internet access, we have produced a CD-ROM, Living Waters of the Chesapeake, that contains similar information. This is particularly important since targeted users include urban schools that currently lack Internet access. By communicating watershed dynamics and connecting with communities, we aim to inspire stewardship and environmental leadership.

Charles County Watershed Prioritization

Ian Botts, Michael Pieper, Nathan Drescher, William Frost, KCI Technologies, Inc., MD 21030, (410) 316-7808

ABSTRACT: Charles County, Maryland was issued its second 5-year stormwater NPDES permit in July 2002. One of the requirements in the permit is to use the data gathered as a result of prior NPDES activities to prioritize all watersheds within Charles County in the context of water quality.

This work was recently completed by Charles County and its consultant, KCI Technologies, using a GIS-based analysis of restoration needs for the County's watersheds, based on the Maryland DNR 12-digit watershed segmentation.

Prioritization was determined utilizing a weighted model employing the raster data capabilities of ESRI'S Spatial Analyst extension to ArcView. This model was built using available GIS data from a variety of sources. The most relevant GIS data in determining watershed prioritization were:

DNR Wetlands
Wetlands of Special State Concern
Census Blocks
Forest Cover
Modeled TN Loads
Modeled TP Loads
Modeled Zn Loads
Modeled TSS Loads
Land Use
Impervious Surfaces
Riparian Zones
Critical Areas

Each vector data layer was converted to a raster grid utilizing Spatial Analyst and a weighting system was then applied to produce a map showing watershed conditions. A weighting factor was applied to each grid based upon how well it discriminated between areas of high and low quality. The weighted grids were then added together utilizing the raster utilities in Spatial Analyst to produce a composite raster representing areas of potential watershed impact.

The result is a ranking of Charles County's watersheds showing which are in most need of restoration, and which have the highest priority for preservation. The work is currently being used to identify areas where additional monitoring will be conducted in support of potential restoration projects.

Comparability of Benthic Macroinvertebrate Mult-habitat Sampling

David Bressler and James B. Stribling, Tetra Tech, Inc., 10045 Red Run Boulevard, Suite 110, Owings Mills, MD 21117, (410) 356-8993

ABSTRACT: Documentation of data quality characteristics is necessary to understand the confidence with which biological assessment data from multiple sources can be compared or combined into larger data sets. We evaluate the comparability of three benthic multi-habitat sampling methods that varied in their approaches for allocating sampling effort among habitats, using three performance characteristics: 1) sensitivity, 2) repeatability, and 3) comparability. Each method was used to sample the same 11 sites in and around Rockdale County, Georgia. Method sensitivity assessed the ability of method-specific multimetric index scores to reflect impairment, as defined *a priori*. Comparability was represented by among-method precision, which described the ability of each method to reproduce results (repeatability). Results showed that within- and among-method precisions were relatively similar to one another suggesting that differences in the allocation of sampling effort among habitats did not dramatically affect final assessments. Accuracy was difficult to fully evaluate because of the limited number of reference and stressor sites; however, all the methods were able to detect impairment as represented by high discrimination efficiencies. Our results lend support to combining or comparing large data sets from multi-habitat sampling if other aspects of data quality are controlled.

Accessing Vegetative Factors Before and After Stream Restoration

Lakesha Coates, Maryland Department of Natural Resources, 580 Taylor Avenue, E-2, Annapolis, Maryland 21401, (410) 260-8813, fax: (410) 260-8779, LCoates@dnr.state.md.us

ABSTRACT: Since the summer of 2001, the Maryland Department of Natural Resources (MD DNR) and the Maryland Department of Transportation (MDOT) have joined in an inter-agency effort to assist existing State and local partnerships in an effort to protect and restore streams historically subjected to degradation by highway construction and runoff. The goal of the program is to restore in-stream fish and wildlife habitat in targeted areas. This joint effort is known as the Governor's Watershed Revitalization Partnership. MD DNR and MDOT are funding this effort through a portion of the 1998 Transportation Equity Act for the 21st Century (TEA-21).

Projects were selected based on local stream characteristics and project goals such as: mitigation of impacts from roads and bridges, reduction of nutrients and sediment, reduction of stream bank erosion, enhancement of the quality of life of communities, and the revitalization of community open space. Preference was given to projects with the following characteristics: emphasis on natural design, part of an ecosystem-based watershed management plan, emphasis on community involvement, demonstration of innovative restoration techniques, and pre- and post monitoring.

The purpose of monitoring is to identify and quantify techniques that enhance stream habitat and reduce erosion and sediment pollution. The methods and parameters vary from project to project and are based on the conditions and needs identified locally. There are 15 stream restoration projects approved for funding and ready for construction. These projects are located throughout the state. Eight county-sponsored projects are in Anne Arundel County, two each in Baltimore and Harford County Allegany, and one in Calvert County. Baltimore City is the local sponsor of one project, and in western Maryland, Allegany County Soil Conservation District is a local sponsor. Biological monitoring is currently underway at Biddison Run stream in Baltimore City. The monitoring consists of habitat assessment, fish sampling, macro-invertebrate sampling, water quality, and vegetation surveys.

Community Based Monitoring of the Restoration of Biddison Run

Darin Crew (dcrew@herringrun.org), Herring Run Watershed Association (www.herringrun.org), 4337 Harford Rd., Baltimore, MD 21214 (410) 254-1577, fax(410)254-2206, Van Sturtevant, Baltimore City Public Works, Department of Environmental Services

ABSTRACT: In 2000, the Herring Run Watershed Association, Baltimore City, Baltimore County, and other local watershed associations and concerned citizens gathered for a charette to discuss the state of the urban waterways of the city. The resulting action from the charette identified Biddison Run as a prime restoration target for funding under TEA-21.

Biddison Run flows through the closed Bowleys Lane Landfill. High flows generated by the highly urbanized watershed have caused the stream to channelize and erode the slopes of the landfill, leading to the transport of trash, sediment, and landfill leachate to Herring Run. In addition, the mouth of Biddison Run has gabions that block fish passage upstream from Herring Run. In order to evaluate the restoration of Biddison Run, the City of Baltimore hired a contractor to manage the restoration portion of the project, while HRWA, using established EPA protocols, will monitor the in-stream conditions of Biddison Run.

This poster examines how HRWA is using volunteers to monitor the biological, chemical, and physical habitat of Biddison Run. These data will be used to judge the success of the restoration project. Since construction of the restoration project has not begun, effectiveness of the project will be based on improvements to the physical habitat, biological communities, and water quality at the two sites. The effectiveness of the riparian planting will be assessed by MD DNR. Monitoring will continue in 2004 once construction is complete. This project will help Baltimore City and HRWA hone our ability to monitor and evaluate stream restoration projects while building capacity for members of HRWA to understand and participate in watershed planning and restoration efforts.

Watts Branch Watershed and Stream Assessment, Washington D.C.

Chris Eng, Richard Starr, Tamara McCandless, Stream Habitat Assessment and Restoration Program, Chesapeake Bay Field Office, U. S. Fish and Wildlife Service

ABSTRACT: The U.S. Fish and Wildlife Service, Chesapeake Bay Field Office (Service) and the District of Columbia, Department of Health (DOH), Watershed Protection Division formed a partnership to restore stream systems within Washington D.C. As part of this partnership, the Service completed a fluvial geomorphic-based watershed and stream assessment of Watts Branch in September 2002. The project objectives were to: 1) determine the relationship between watershed landscape activities and stream processes; 2) characterize physical conditions of the stream; 3) identify watershed and in-stream conditions impacting the stream and riparian habitat; and 4) target and prioritize watershed and stream conditions for restoration or enhancement.

The survey results showed that the effects of land cover and land use activities on stream stability and habitat conditions in Watts Branch are typical of most urban watersheds. The large amounts of impervious surface in the Watts Branch watershed cause high stormwater runoff, high peak stream discharges, high flow velocities, flashy flows, low groundwater recharge, low base flows, poor water quality, high stream instability, poor in-stream habitat, and variations in sediment production. Furthermore, stream instability and poor in-stream habitat is aggravated by an extensive number of stormwater outfalls (41), several exposed utility crossings (7), sewer line leaks, and narrow to non-existent riparian buffers. Essentially 100 percent of Watt's Branch has been channelized or altered. The upstream reaches are entrenched and confined and have lost access to their floodplains due to fill and/or channel capacity enlargement from erosion. The downstream reaches are aggrading due to an increased sediment supply, a likely result of upstream stream instability problems.

The Service used a variety of criteria to identify and prioritize stream stability and the relative severity of the instability. Criteria included channel shear stress, bank erodibility, width/depth ratio, stream entrenchment, and incision. The Service also considered stream sensitivity characteristics based on management interpretations of various stream types presented in Rosgen(1996), including disturbance sensitivity, recovery potential, bank erosion potential, and sediment potential. Because of the severe impairment throughout Watts Branch, the Service rated all of Watts Branch as high restoration priority. The Service also identified and prioritized restoration opportunities within the watershed primarily based on outfalls and their drainage areas and land uses.

The report recommends using a natural channel design approach to restore the degraded reaches of Watts Branch; repair sewer lines; reduce runoff; repair and relocate utility lines and outfalls; and establish and/or expand riparian buffers. There are several options available for restoring Watts Branch. They range from reestablishing the stream on a historic floodplain to stabilizing the stream in place. There are associated advantages and disadvantages for each option. A multi-

agency group, which includes the Service, DOH, and Corps of Engineers will select the preferred alternative during the next phase - design phase.

National Water Quality Monitoring Council (NWQMC)

J.B. Griffin (jbgriff@usgs.gov), U.S. Geological Survey, Water Information Coordination Program, 417 National Center, Reston, VA 20192, (703) 648-5229 (Tel), (703) 648-5644 (Fax)

ABSTRACT: The National Water Quality Monitoring Council (Council), formed in 1997, consists of 35 members who form a balanced representation of Federal, interstate, State, Tribal, local and municipal governments, watershed and environmental groups, the volunteer monitoring community, universities, and the private sector, including the regulated community. The Council is a subgroup of the Advisory Committee on Water Information that was established under the Federal Advisory Committee Act.

The purpose of the Council is to provide a national forum for coordination of consistent and scientifically-defensible methods and strategies to improve water quality monitoring, assessment, and reporting. The Council promotes partnerships to foster collaboration, advance the science, and improve management within all elements of the water quality monitoring community as well as to heighten public awareness, public involvement, and stewardship of our water resources.

The Council and its work groups are working to define and promote systems to improve the monitoring of the chemical, physical, and biological aspects of water quality found in surface waters, ground waters, and coastal systems. A major focus of the Council is to develop a widely accepted monitoring framework from which consistent and comparable water quality information can be produced. The work groups are:

Water Information Strategies: To create and communicate goal-oriented monitoring design guidance that results in comparable information, over time and space, being produced in support of management decision making.

Data Methods and Comparability Board: To explore, evaluate, and develop methods and approaches to measurement that facilitate collaboration and promote comparability between water quality monitoring programs.

Collaboration and Outreach: To build and support creative partnerships among the many elements of the monitoring community. So far, fourteen state and regional monitoring councils have been formed.

Watershed Components Interaction: To provide a national forum to advance the integration of ground and surface water monitoring to more fully understand the connected nature of these watershed components and their combined impact on the ecological integrity of the hydrologic system.

For more information on the Council, see their website at http://water.usgs.gov/wicp/acwi/monitoring/.

River Restoration in our Nation: A Scientific Synthesis to Improve Results

B.A. Hassett[1] (bhassett@umd.edu), E.S. Bernhardt[1], M.A. Palmer1, J.D. Allan[2],
M. Bowman[3], and the National River Restoration Science Synthesis working group[4],
Palmer Lab-Dept. of Entomology, University of Maryland, 4176 Plant Sciences Bldg.,
College Park, MD 20742, (301) 405-3799

ABSTRACT: A great deal of money and effort is expended today in stream restoration, yet too little energy has been directed toward learning what works and what does not, and how to make projects more effective in restoring river health. Given the urgent concerns over the health of our waterways, the timing is right for a rigorous scientific evaluation of our progress. The National Riverine Restoration Science Synthesis working group was formed to collect and synthesize information about stream restoration activities around the country; assess the state of both the science and the practice of river restoration; identify and communicate success stories; and make specific recommendations for improvements. The conservation of freshwater ecosystems in North America requires not only the protection of the best remaining locations, but also the managed recovery of altered and degraded ecosystems. Within areas of substantial human activity, even the aquatic ecosystems of highest value and quality experience significant stress from human actions. These systems will require some degree of management, which will benefit from a more mature science of restoration ecology.

[1] Departments of Biology and Entomology, University of Maryland, College Park, MD 20742
[2] School of Natural Resources, University of Michigan, Ann Arbor, MI 48103
[3] American Rivers, Washington, D.C. 20005
[4] The National River Restoration Science Synthesis is a working group affiliated with the National Center for Ecological Analysis and Synthesis and includes faculty and students from 9 universities and research institutes and USGS NBII collaborators

Coupling Science with Outreach: Maryland's Stream Waders Program

Ronald J. Klauda, Daniel M. Boward, and Rita M. Bruckler, Maryland Department of Natural Resources, Monitoring and Non-Tidal Assessment Division, 580 Taylor Avenue, C-2, Annapolis, MD 21401

ABSTRACT: The Department of Natural Resources (DNR) is Maryland's lead agency in the multi-jurisdictional Chesapeake Bay Restoration Program. One important commitment of the Bay Program is to work with local governments, community groups, and watershed organizations to develop and implement watershed management plans to deal with non-point source pollution throughout the 64,000 square mile watershed. Achieving this commitment in Maryland will require sound science in the form of monitoring data from the state's 15,000+ miles of streams, plus a knowledgeable citizenry willing to change their behavior to protect the state's watersheds.

To help DNR monitor and educate, a statewide volunteer monitoring program called Stream Waders was started in 2000, with more than 200

volunteers sampling over 700 sites. Since then, a total of 611volunteers have sampled 2100 sites for DNR, and have significantly contributed to the growing information base on the health of Maryland's streams. Each volunteer attends an intensive day-long training session in basic stream ecology and assessment methods using benthic macroinvertebrate collections. Volunteers then commit to spending 2-3 days sampling up to 20 stream sites during March and April. Samples collected by the volunteers are processed by DNR staff, identified to the family taxonomic level, and counted. The results are used to supplement annual assessments of stream health completed by DNR.

More than ten local governments, over 40 volunteer organizations, and teachers from K-12 schools throughout Maryland had participated in the Stream Waders Program. Volunteers have received the program with enthusiasm. We have learned that participation in Stream Waders has heightened their awareness and knowledge of the health of Maryland's streams. Many volunteers have been inspired to increase their involvement in watershed protection.

James Island Habitat Restoration and Assessment of Existing Environmental Conditions

S.T. Koser (skoser@eaest.com), J. Matkowski, J. Boraczek, EA Engineering, Science, and Technology, Inc., (410) 771.4950, fax: (410)771-4204, and K.Cushman, Maryland Environmental Service

ABSTRACT: James Island is located in Dorchester County, Maryland, at the mouth of the Little Choptank River in the Chesapeake Bay. James Island and surrounding waters were investigated over four seasons to assess the existing terrestrial and aquatic resources present in and around the James Island remnants and to monitor seasonal changes. Historic and current mapping of the island indicate that over 800 acres of the island has eroded since 1847; the island currently consists of three remnants and is less than 100 acres in size. The erosion of Bay islands as a result of mean sea level rise is thought to be a natural process and a result of glacial melt that may or may not be a natural trend or due to global warming. It has been estimated that if nothing is done to prevent the current erosion of the Bay islands, they will disappear in the next 100 years.

Data were collected to support assessment and feasibility-level studies of James Island as a potential island habitat restoration project using dredged material. Specifically, James Island is currently being considered for an island restoration project that includes both wetland and upland cells using 40 to 80 million cubic yards of suitable dredged material. Currently, five potential dike alignments are being considered at this phase of study. The alignments range in size from 979 to 2,202 acres and all lie predominantly west of the remnants of James Island. The results from site assessment efforts of the sampling for feasibility-level evaluations from Fall 2001 to Summer 2002 are presented. Components of the investigation included an analysis of the benthic community, in situ water quality, fisheries studies, plankton collections, wildlife and avian observations, terrestrial and submerged aquatic vegetation mapping. This study was conducted by EA Engineering, Science, and Technology, Inc.(EA) for the

Maryland Port Administration (MPA) under contract to Maryland Environmental Service (MES).

Interpretation of the Fluvial Geomorphic Response of Streams to Developing Watersheds

Hunt Loftin, Tetra Tech Inc, 10306 Eaton Place, Suite 340, Fairfax, Virginia 22030

ABSTRACT: Howard County is on its third year of an ongoing monitoring program to characterize the in-stream response that results when a watershed of forest and cropland is converted to residential development that employs stormwater best management practices designed in accord with Maryland's 2000 Stormwater Design Manual. Chemical, physical and biological responses are being monitored. This poster will present the preliminary findings primarily of the physical response and provide a monitoring and analysis approach to better interpret the fluvial geomorphic response to the land use changes. The approach describes the fluvial geomorphic response that would be anticipated from the pre-developed land use and provides benchmarks that can be used to assess whether construction practices and implemented stormwater best management practices are adequately protecting the stream from adverse physical impacts. This approach permits the evaluator to step back from rare and extreme weather events that can create significant one-time changes to stream geomorphology; rather the approach favors a trend analysis, which better comports with the actual response mechanisms of a stream system.

From Drought in 2002 to Recovery and Flooding in 2003

Wendy S. McPherson, U.S. Geological Survey, wsmcpher@usgs.gov

ABSTRACT: In 2002, the Mid-Atlantic region experienced one of the worse droughts in history; however, above normal precipitation during the summer of 2003 led to a full recovery that ultimately led to flooding and very high water levels. The U.S. Geological Survey (USGS), which has many monitoring systems in wells and streams in Maryland, was in an ideal position to record the record levels during these extreme hydrologic periods.

During the drought period in 2002, most of the ground-water levels were below normal. Out of a total of 16 wells located within the region, six reached their lowest June levels in more than 40 years; exceeding the low water level records set during the drought of the 1960s. Several months of abundant rainfall in 2003 led to a full recovery from the drought and by June, all the USGS wells in the region had levels that were above normal. Specifically, six of the wells in the region were at their highest June levels in 40 years.

Flow to the Chesapeake Bay also went from near record lows in 2002 to near record highs in 2003. With stream flow and groundwater levels already high, tropical storm Isabel engulfed the Mid-Atlantic region on September 19, 2003 and precipitation associated with the storm raised groundwater and stream flow levels even higher. The increase in water levels caused an inundation of the low-lying areas along the shores of the Chesapeake Bay, including Baltimore's Inner Harbor. Additional inches of rain on September 22-23 resulted in flooding in several Maryland streams and a near record high total flow into the Chesapeake

Bay for September. Long-term data collected in the region will show that never before have such extreme changes in water levels been experienced during a short period of time.

Aquatic Benthic Macroinvertebrates as Indicators of the Health of a Coastal Plain Stream

Karyn Molines (karyn@jugbay.org), Jug Bay Wetlands Sanctuary, 1361 Wrighton Road, Lothian, MD 20711, (410) 741-9330

ABSTRACT: The recent failing water quality grades the Chesapeake Bay received has alarmed us all. Water in the Bay comes from many sources, however the Patuxent River is a large contributor and influences the Bay's water quality. The Patuxent River's flow, in turn, originates in smaller streams, one of them being Two Run Creek, a Coastal Plain non-tidal stream located within the Jug Bay Wetlands Sanctuary in Lothian, Maryland. Since 1996, volunteers, under the direction of a staff naturalist, have collected benthic macroinvertebrates, which they have sorted, identified, and counted in order to assess overall stream health. Samples were collected in D-nets using a method based on the Maryland Biological Stream Survey's Stream Waders program. Twenty representative samples of five microhabitats were taken within the 75-meter reach of the Creek quarterly, in January, May, July, and September. Three metrics of biological integrity were evaluated: *Taxonomic Richness*; *Number of Ephemeroptera, Plecoptera*, and *Trichoptera (EPT) families*; and *Percent Ephemeroptera*. Scores were ranked as Good, Fair, or Poor, based on statistics developed by the Maryland Department of Natural Resources. All but one of our twenty samples rated either "Fair" or "Good" in terms of *Taxonomic Richness*. Using the *Number of EPT*, Two Run Creek rated as "Fair" or "Good" in 70% of our samples. Four of the six "Poor" samples occurred during the summer. If we removed summer data, we found that 88 percent of the samples rate "Fair" or "Good." Based on *Percent Ephemeroptera*, the Creek rated "Fair" to "Good" in 95 percent of the samples. Noticeable seasonal and yearly variations occurred in the data. As with all of the research projects at Jug Bay Wetlands Sanctuary, ecological monitoring was only one facet of the study. Just as important, this research provided an opportunity for the public to become citizen scientists and to learn about natural science.

Will *Crassostrea virginica* Thrive in the Magothy River? A Study of Oyster Gardens in a Mesohaline Chesapeake Bay Tributary

Kate O'Mara (komara@allvantage.com) and Sally G. Hornor, Anne Arundel Community College, 3115 Arrowhead Farms Road, Gambrills, MD 21054, (410) 451-9258

ABSTRACT: The purpose of this study was to determine the survivability and growth rate of oysters from spat set through their first year. As part of the Chesapeake Bay Foundation's Oyster Gardening Program, gardeners received two bags of spat on shell (approx. 200 shells per bag), which had been spawned at the Horn Point Laboratory Oyster Hatchery in Cambridge, MD. Eighteen oyster gardens, consisting of four oyster cages that volunteers built at a CBF-sponsored workshop, were monitored within the Magothy River watershed. Sites were visited three times: in December 2002, in April and in May 2003. The shell length of a subset of oysters was measured at each site and water quality data (Secchi Disk depth, temperature, salinity, dissolved oxygen, dissolved oxygen percent saturation) were collected. While growth rates were variable and water quality parameters were not predictive of growth rate and mortality, overall viability of oysters was good. Out of the oysters sampled at 17 sites, 9 sites had greater than 70 percent survival. Of those 9 sites, 7 had survival above 90 percent. Growth rates varied from negligible to 0.19 mm/day during the five-month monitoring period. This study will continue in 2003 as gardeners receive newly spawned oysters. Also included in the study will be spat from native Magothy oysters.

Monitoring Anti-microbial Compounds as Indicators of Sewerage Problems Impacting Urban Streams

Daniel Paull, Rolf U. Halden, Johns Hopkins Bloomberg School of Public Health, Department of Environmental Health Sciences, 615 North Wolfe Street, Suite W6001 Baltimore, MD 21205-2103, (410) 955-2609, fax: (443) 287-3560, http://www.jhsph.edu/dept/ehs/Halden

ABSTRACT: Sewerage leaks and overflows represent a serious threat to the water quality and ecological health of surface waters, particularly in urban environments. Early detection of such events is critical for locating and eliminating the underlying root causes in order to protect the aquatic ecosystem and the health of local human populations.

This study explored the usefulness of anti-microbial compounds as chemical indicators of sewage spills. Synthetic biocides are the active ingredient in anti-microbial personal care products including soap, detergent, tooth paste, mouth rinse, and other cosmetic items. Since waste water is the principal route of disposal for these household items, sewage spills are expected to cause elevated concentrations of anti-microbial compounds in impacted surface waters.

We tested this hypothesis by analyzing grab samples from Baltimore streams at locations with known sewerage problems. Concentrations of two polychlorinated aromatic biocides were monitored in source water and upstream and downstream of point sources along the Jones Falls, Gwynns Falls, and Maiden Choice Run. Target compound concentrations were high in source water and elevated in samples taken downstream of the point sources. The results suggest that both compounds may serve as chemical indicators of sewage contamination in Baltimore streams.

Watershed-Based Biological Monitoring in Howard County, Maryland

Kristen L. Pavlik and James B. Stribling, Tetra Tech, Inc., 10045 Red Run Blvd., Suite 110, Owings Mills, MD 21117

ABSTRACT: To gain an understanding of changing watershed conditions, the Howard County Stormwater Management Division (SWMD) finalized a plan designed to monitor all 15 of its subwatersheds over a five-year period. The primary goal of the program is to assess the current biological condition of Howard County streams and watersheds, as well as to establish a baseline for comparing future

assessments. The county wants to be able to detect a 30 percent change in watershed condition 80 percent of the time, with a 95 percent confidence level.

The network design and site selection are based on a 1:100,000 map scale, allowing the county to be in agreement with the design of the statewide Maryland Biological Stream Survey (MBSS). Over a three-year period, several indicators (benthic macroinvertebrates, fish, physical habitat quality, sediment particle size distribution, and channel morphology) were sampled at over 150 stream locations throughout Howard County, using MBSS and modified U.S. EPA Rapid Bioassessment Protocol (RBP) methods. Duplicate samples were taken at 10 percent of the sites to address measurement error.

Cumulatively, in the first two years, over 300 different genera of benthic macroinvertebrates have been found, including a possible new species of tubificid worm (Oligochaeta: Tubificidae). Using the MBSS Benthic Index of Biological Integrity (B-IBI; based on a 5-point scale), mean biological condition (county-wide) was found to be in the “fair” range (3.10 ± 0.74, n = 90), with physical habitat quality rated as “non-supporting” (108.47 ± 7.31, 54 percent of maximum). These results represent the first cycle of county sampling.

Assessing Restoration Opportunities in Lower Bush Creek Watershed, Frederick County, Maryland

Morris Perot (perotmor@versar.com), Nancy Roth (rothnan@versar.com), and Sanjay Chandra, Versar Inc.9200 Rumsey Road, Columbia, MD 21045, (410) 964-9200, Shannon Moore, Frederick County Division of Public Works.

ABSTRACT: The Lower Bush Creek Watershed in Frederick County, Maryland, is a relatively rural area that is experiencing rapid growth and development. Given the potential for urban watershed stresses to impact streams, Frederick County Division of Public Works sponsored a study to identify opportunities to improve and protect water quality and stream conditions. To identify the best sites for stream restoration and stormwater management (SWM) controls within the study area, Versar applied a multi-step restoration targeting approach. Existing background information was reviewed, including a 2001 watershed assessment, long-term stream monitoring data, maps, aerial photographs, and geographic information systems (GIS) data. Initial findings were used to focus field efforts downstream of developed areas. Teams conducted stream reconnaissance walks to identify degraded conditions indicative of upstream SWM problems and other stream restoration opportunities. Detailed data, site coordinates, and photographs were recorded. Further site visits were conducted to evaluate existing land uses, stormwater management structures, and drainage pathways to evaluate water pollution and hydraulic/hydrologic stressors. Major problem types included hydrologic modifications, erosion and channel destabilization, and non-point source pollution. Twenty-four candidate restoration sites were identified and ranked: six sites presented opportunities for both stream restoration and SWM controls; seventeen were candidates for stream restoration; and one site presented an opportunity for SWM maintenance.

Streamstats: A U.S. Geological Survey Web Site for Stream Information

Kernell G. Ries III (kries@usgs.gov), U.S. Geological Survey, 8987 Yellow Brick Road, Baltimore, MD 21237, (410) 238-4317, fax: (410) 238-4210

ABSTRACT: Estimates of stream flow statistics, such as the 100-year flood, the mean annual flow, and the 7-day, 10-year low flow are needed for design of bridges and other structures, for floodplain mapping, and for water-resources planning and management. The U.S. Geological Survey regularly publishes stream flow statistics for its data-collection stations, but estimates are often needed at locations where no data are available.

The U.S. Geological Survey has developed a prototype Web application, named Streamstats, to provide simple methods for obtaining stream flow statistics and other information for gaged and ungaged streams in the United States. StreamStats users can click on gaging station locations in a map interface to obtain stream flow statistics and other information for the sites. Users can click on any point on a stream to obtain estimates of stream flow statistics and other information for the ungaged site. StreamStats sends the coordinates for the ungaged site to a server that runs a GIS, which determines the basin boundary for the site, measures various basin and/or climatic characteristics, and inserts the characteristics into regression equations to obtain estimates of stream flow statistics for the site. Streamstats also provides information on the reliability of the estimates.

Streamstats reduces the time needed to estimate stream flow statistics for ungaged sites from at least several hours to only a few minutes. It is currently only available for Idaho, but it is expected that several other states will be implemented within a year. StreamStats could rapidly be implemented for Maryland with support from local agencies.

The Clickable Map Concept: Status of the Data Management Committee's Efforts to Provide Metadata Through a Geographic Information System

Matthew Rowe, Technical and Regulatory Services Administration, Maryland Department of the Environment, Technical and Regulatory Services, Montgomery Park Business Center, 1800 Washington Blvd, Suite 540, Baltimore, MD 21230-1718, (410) 537-3578, fax (410) 537-3873, **mrowe@mde.state.md.us**, Chris Swan, Department of Geography and Environmental Systems, University of Maryland, Baltimore County, 211 Social Sciences Building, 1000 Hilltop Circle, Baltimore, MD 21250, http://www.wam.umd.edu/~cmswan

ABSTRACT: The Maryland Water Monitoring Council's (MWMC) Data Management Committee (DMC) has developed a GIS Web interface (Figure 1) to display planned water quality monitoring activities in the State. Development of the map is a cooperative endeavor between the Maryland Department of the Environment, which maintains the map, and the University of Maryland Baltimore County, which hosts and updates the Web site (located at http://www.cuereims.umbc.edu/MWMC). The original purpose of the map was

to provide academia, volunteer monitoring groups, and resource managers from all levels of government with the monitoring program metadata (e.g., station data, contact information) necessary to improve inter-program communication, coordination, partnering, and efficient use of aquatic monitoring resources in Maryland. Using information gathered from the MWMC's Monitoring and Assessment Committee's Stream Roundtable (Winter 2003), the DMC created an Internet Map Server (ArcIMS) to make this aquatic monitoring information readily available to any interested party having an Internet connection.

Having accomplished this initial goal, the DMC is discussing ideas for enhancing the current mapping interface through providing more comprehensive monitoring program data, providing watershed status and trends, allowing a querying capability, adding more data layers, and providing extensive links to other related sites. The DMC is currently revising the data request for the 2004 Stream Roundtable in order to acquire additional information for the next map update. The DMC hopes to receive broad input and suggestions from the water monitoring community on ways to make the MWMC's ArcIMS system a more useful tool to water monitoring groups and organizations across the State.

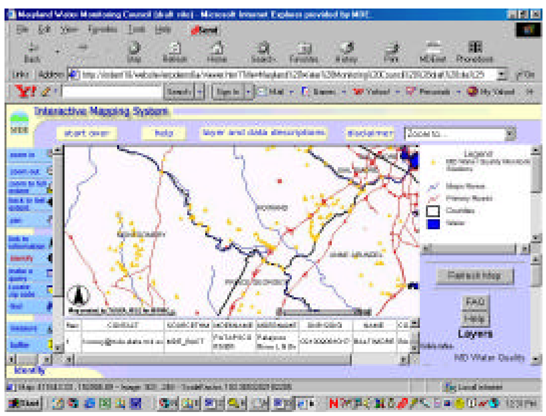

Figure 1: The MWMC's Internet Map Server

The Use of Impervious Cover in Rapid Watershed Planning

Paul Sturm, Karen Cappiella, Center for Watershed Protection, 8390 Main Street, 2nd Floor, Ellicott City, MD 21043, (410) 461-8323, fax (410) 461-8324, pes@cwp.org

ABSTRACT: Current and future impervious cover are important parameters to estimate in order to understand and effectively manage urban and suburban watersheds. Fairly simple and rapid methods are available to estimate impervious cover using Geographic Information Systems (GIS). By combining impervious cover estimates with existing water quality data, and additional field data, realistic restoration and protection goals can be set for individual subwatersheds of about 1-10 square miles. Impervious cover estimates provide an understanding of both current and likely future land use and biological conditions.

In Williamsburg Virginia, the Center for Watershed Protection combined impervious cover estimates, stakeholder involvement and field assessments to set goals for each of the 12 subwatersheds in the Powhatan Creek watershed. Subwatersheds that contained less than 10% impervious cover also contained large tracts of contiguous forest, rare plant and animal species, and the high

quality streams. Impacted subwatersheds, with greater than 10% impervious cover, contained many actively incising streams with fair or poor habitat. These symptoms of degradation were particularly evident in the first order reaches where recent development has occurred.

Outcomes of the stakeholder process included recommendations for protection of the remaining sensitive subwatersheds, rehabilitation of impacted subwatersheds, and some redirection of future growth (i.e., smart growth) into the already impacted subwatersheds. Specific recommendations to achieve those desired outcomes, along with estimated costs and responsibilities, were set to help guide implementation and budgeting for the plan. Twenty of the twenty-four recommendations were adopted by the James City County Board of Supervisors, by a vote of 6-0, with the four remaining recommendations set for additional study. Resources for implementation of the plan have been added to the County's capital budget, and plan implementation is currently underway.

Short-Term Impacts of Hurricane Isabel on Maryland's Chesapeake Bay Water Quality

Mark Trice, Chris Heyer, Bill Romano, Bruce Michael, Resource Assessment Service, Tidewater Ecosystem Assessment Division, Maryland Department of Natural Resources, Tawes State Office Bldg., D2, 580 Taylor Avenue, Annapolis, MD 21401, (410)260-8649, (fax) (410)260-8640

ABSTRACT: The Maryland Department of Natural Resources, Resource Assessment Service, conducted routine and special water quality sampling prior to and after Hurricane Isabel to assess the storm's impacts on Chesapeake Bay water quality. Data from a statewide network of 16 continuous water quality monitors collected dissolved oxygen, turbidity, chlorophyll, pH, water temperature and salinity data at 15-minute intervals throughout the period. Increases in salinity on the order of 1-7 ppt were observed during the hurricane-induced tidal surge, except in extreme upriver sites that saw decreases in salinity due to high freshwater flows. Most stations also observed large one-day spikes in turbidity immediately following the storm, and chlorophyll peaks five to six days afterwards, with resultant low dissolved oxygen.

Pre- and post-hurricane sampling was conducted at long-term fixed stations on the main-Bay and Potomac River, showing increases in salinity, decreases in water clarity and higher bottom dissolved oxygen levels as a result of water column mixing from winds and the tidal surge. Fixed station nutrient data are currently being analyzed in the laboratory and may be available at the time of poster presentation.

Spatially intensive water quality mapping data were collected on the Magothy and Middle Rivers immediately before and after Hurricane Isabel. The ephemeral turbidity events were not captured in the water quality mapping data, but high spatial resolution changes in salinity within these tributaries were documented.

Ecological Restoration of Urban Streams: Using Living Resources to Measure Success

Keith Van Ness (Keith.VanNess@montgomerycountymd.gov), Montgomery County Department of Environmental Protection, Watershed Management Division, Doug Redmond, Maryland-National Capital Park and Planning Commission, Countywide Planning Division

ABSTRACT: In February 1998, Montgomery County completed an assessment of biological, chemical, and habitat conditions covering most of the streams within county boundaries. The resulting Countywide Stream Protection Strategy (CSPS) evaluated stream conditions based upon aquatic life and stream channel habitat indicators. The CSPS has been recently updated to provide a comprehensive picture of stream conditions (Table 1), and it documents the progress the County is making in addressing watershed management and restoration priorities originally identified in the first CSPS.

Table 1. 1994-2000 County Stream Conditions

Stream Condition	Stream Miles	Percent of Streams Monitored
Excellent	**84**	**7**
Good	**694**	**55**
Fair	**362**	**28**
Poor	**131**	**10**
Total Monitored	**1272**	**100**

Stream erosion and sedimentation remain the dominant impacts on county streams. There are also isolated instances where other pollutant sources were a primary cause of biological impairment. The most severely impaired streams are generally found in older, “down-county” urban areas.

This poster examines how Montgomery County uses the results of watershed-based biological and habitat monitoring to identify areas for restoration, identify project goals, and to assess the success of completed projects. Hydrological and geomorphological data are essential to the planning and design of restoration projects. However, restoring conditions so that diverse communities of organisms can once again live in urban streams is the ultimate measure of restoration success for the county. Examples of restoration projects include Sligo Creek, Colesville Depot Tributary, Gum Springs Bypass, and the Northwest Branch at Old Randolph Road.

BOARD OF DIRECTORS
Maryland Water Monitoring Council

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Mr. Anthony V. Allred, Jr.
Maryland Department of Natural Resources
Tawes Building, D-2
580 Taylor Avenue
Annapolis, MD 21401
(term -1 year)
Tel 410-260-8642
Fax 410-260-8640
tallred@dnr.state.md.us

Mr. Kenneth T. Belt
USDA Forest Service
Urban Forestry Ecological Research Unit
Baltimore Ecosystem Study LTER
Rm. 134 TRC Bldg.
University of Maryland at Baltimore County
5200 Westland Blvd.
Baltimore, MD 21227
(term -1 year)
Tel 410-455-8011
Fax 410-455-8025
belt@fs.fed.us

Ms. Christine Buckley
Harford County Department of Public Works
220 South Main Street
Bel Air, MD 21014-3865
(term -1 year)
Tel 410-638-3545
Fax 410-893-3849
cbuckley@co.ha.md.us

Dr. Mark Castro
UMCES/Appalachian Lab
301 Braddock Road
Frostburg, MD 21532-2307
(term - 3 years)
Tel 301-689-7163
Fax 301-689-7200
castro@al.umces.edu

Mr. Brian Clevenger
Maryland Department of the Environment
Water Management Administration
1800 Washington Blvd., Suite 540
Baltimore, MD 21230-1718
(term -1 year)
Tel 410-537-3543
Fax 410-537-3553
bclevenger@mde.state.md.us

Ms. Kim Coble
Assistant Director, Maryland Office
Chesapeake Bay Foundation
6 Herndon Ave.
Annapolis, MD 21403
(term - 2 years)
Tel 410-268-8833
Fax 410-280-3513
Kcoble@cbf.org

Mr. Jim Cummins – Monitoring and Assessment Committee Co-Chairman
Interstate Commission on the Potomac River Basin Commission
6110 Executive Blvd., Suite 300
Rockville, MD 20852
(term -1 year)
Tel 301-984-1908 x106
Fax 301-984-5841
jcummins@Potomac-Commission.org

Mr. Tom Devilbiss
Carroll County Bureau of Resource Management
and Protection
225 North Center Street
Westminster, MD 21157
(term - 3 years)
Tel 410-386-2639
Fax 410-386-2120
tdevibiss@ccg.carr.org

Mr. John Grace
Water Supply Program
Maryland Department of the Environment
1800 Washington Blvd., Suite 540
Baltimore, MD 21230-1718
(term - 2 years)
Tel 410-537-3714
Fax 410-537-3157
jgrace@mde.state.md.us

Ms. Mary Ellen Ley
USGS/Chesapeake Bay Program
410 Severn Ave., Suite 109
Annapolis, MD 21403
(term - 2 years)
Tel 410-267-5750
Fax 410-267-5777
mley@chesapeakebay.net

Ms. Abby Markowitz
Tetra Tech, Inc.
10045 Red Run Blvd., Suite 110
Owings mills, MD 21117
(term - 3 years)
Tel 410-356-8993
Fax 410-356-9005
Abby.Markowitz@tetratech.com

Ms. Angela Morales
Environmental Planner
Howard County Government
6751 Columbia Gateway Dr., Suite 514
Columbia, MD 21046
(term - 2 years)
Tel 410-313-6586
Fax 410-313-6490
amorales@co.ho.md.us

Dr. Andrew Miller
University of Maryland Baltimore County
Department of Geography & Environmental Systems
1000 Hilltop Circle
Baltimore, MD 21250
(term - 2 years)
Tel 410-455-3151
Fax 410-455-1056
miller@umbc.edu

Ms. Nancy Roth
Versar, Inc.
9200 Rumsey Rd.
Columbia, MD 21045
(term -1 year)
Tel 410-740-6091
Fax 410-964-5156
rothnan@versar.com

Mr. Steven Stewart - Programmatic Coordination Committee Chairman
Baltimore County Department of the Environment,
Protection & Resource Management
401 Bosley Avenue, Suite 416
Towson, MD 21204
(term -1 year)
Tel 410-887-5683 x 240
Fax 410-887-4804
sstewart@co.ba.md.us

Mr. Robert J. Shedlock - Vice Chairman of MWMC Board of Directors
U.S. Geological Survey
8983 Yellow Brick Road
Baltimore, MD 21237
Tel 410-238-4203
Fax 410-238-4210
rjshedlo@usgs.gov

Mr. William P. Stack - Chairman of MWMC Board of Directors
Baltimore City, Water Quality Management Office
3001 Druid Park, Room 223
Baltimore, MD 21215
Tel 410-396-0732
Fax 410-523-9047
wstack@prodigy.net

Mr. Paul Sturm
Center for Watershed Protection
8391 Main Street
Ellicott City, Maryland 21043
Tel 410-461-8323
Fax 410-461-8324
(term - 3 years)
pes@cwp.org

Dr. Chris Tanner
St. Mary's College of Maryland
Department of Biology
18952 E. Fisher Rd.
St. Mary's City, MD 20686-3001
(term - 2 years)
Tel 240-895-4374
Fax 240-895-4996
cetanner@smcm.edu

Dr. Carl S. Weber
Department of Biological Sciences
University of Maryland Baltimore County (UMBC)
1000 Hilltop Circle
Baltimore, MD 21250
(term - 1 year)
Tel 410-455-2258
Fax 410-455-3875
weber@research.umbc.edu

Mr. Kenneth Yetman
Watershed Restoration Division
Maryland Department of Natural Resources
Tawes State Office Building, E-2
Annapolis, MD 21401
(term - 2 years)
Tel 410-260-8812
Fax 410-260-8779
kyetman@dnr.state.md.us

Executive Secretary

Dr. Paul E. Miller
Maryland Department of Natural Resources
Monitoring & Non-Tidal Assessment Division
580 Taylor Avenue
Tawes State Office Bldg., C-2
Annapolis, MD 21401
(term -life)
Tel 410-260-8616
Fax 410-260-8620
pmiller@dnr.state.md.us

Committee Chairpersons Not on the Board of Directors

Dr. Ronald J. Klauda - Monitoring and Assessment Committee Co-Chairman
Maryland Department of Natural Resources
Resource Assessment Service
Tawes State Office Bldg., C-2
Annapolis, MD 21401
Tel 410-260-8615
Fax 410-260-8620
rklauda@dnr.state.md.us

Matt Rowe - Data Management Committee Chairman
Maryland Department of the Environment/TARSA
1800 Washington Blvd., Suite 540
Baltimore, MD 21230-1718
Tel 410-537-3578
Fax 410-537-3873
mrowe@mde.state.md.us

Ms. Marcia Smith - Planning Committee Chairman
Maryland Department of the Environment
WMA - Water Rights Division
1800 Washington Blvd., Suite 540
Baltimore, MD 21230-1718
Tel 410-537-3065
Fax 410-537-3163
msmith@mde.state.md.us